

REMARKS

Claims 1-5 and 7-12 were examined and reported in the Office Action. Claims 1-5 and 7-12 are rejected. Claims 1-5 and 7-12 were deleted. New claims 13-23 have been added. Claims 13-23 remain. Applicant notes that a problem with a version of the equation editor resulted in a subsequent misprinting of equation amendments. This was indicated to the examiner during a telephone call. A supplemental response was going to be filed to correct the equation and font problem. The Examiner has since then decided to mail an Office Action disregarding the comments surrounding the error and rejects the amendments on a formal basis. Applicant requests reconsideration of the application in view of the following remarks.

I. 35 U.S.C. § 112

Claims 1-5 and 7-12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claims contain subject matter which was not described in the specification. Applicant has canceled claims 1-5 and 7-12. Therefore the 35 U.S.C. 112, first paragraph rejections are moot.

Accordingly, withdrawal of the 35 U.S.C. 112, first paragraph rejections for Claims 1-5 and 7-12 are respectfully requested.

II. 35 U.S.C. § 103

It is asserted in the Office Action that Claims 1-10 (*sic.*) are rejected in the Office Action under 35 U.S.C. § 103(a), as being unpatentable over U. S. Patent No. 6,343,368 issued to Lerzer ("Lerzer"). Applicant notes that claims 1-10 are canceled (claim 6 being previously canceled). Applicant respectfully traverses the aforementioned rejection in view of new claims 13-21 for the following reasons.

According to MPEP §2142 "[t]o establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary

skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." (*In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)). Further, according to MPEP §2143.03, "[t]o establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (*In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." "All words in a claim must be considered in judging the patentability of that claim against the prior art." (*In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970), emphasis added.)

Applicant's new claim 13 contains the limitations of "[a] turbo decoder having a state metric, comprising: branch metric calculation means for calculating a branch metric by receiving symbols through an input buffer; state metric calculation means for calculating a reverse state metric by using the calculated branch metric at said branch metric calculating means, storing the reverse state metric in a memory, ... wherein the

log likelihood ratio L_k is calculated by using an equation
$$A_{m=0}^{2^v-1} (A_k^{1,m} + B_k^{s(m)}) - A_{m=0}^{2^v-1}$$

$(A_k^{0,m} + B_k^m)$ wherein m is a state of a trellis diagram; k is a stage; $s(m)$ is a function a number complemented a Most Significant Bit(MSB) of binary number of m ; $A_{j=0}^1$ is a

function defined as
$$\sum_{j=0}^1 A_k^j = A_k^0 \quad E \quad A_k^1 = \log_e(e^{A_k^0} + e^{A_k^1}); j \text{ is a } (k-1)^{th} \text{ input for a reverse state}$$

metric; $A_k^{1,m}$ is a k^{th} forward state metric with state m and input 1; $B_k^{s(m)}$ is a k^{th} reverse state metric with state $s(m)$; $A_k^{0,m}$ is a k^{th} forward state metric with state m and input 0 and B_k^m is a k^{th} reverse state metric with state m ."

Applicant's new claim 15 contains the limitations of "[a] calculation method implemented to a turbo decoder, comprising steps of: a) calculating a branch metric by receiving symbols; b) calculating a reverse state metric in case an input i is 0 by using the calculated branch metric and saving the calculated reverse state metric in a memory; c) calculating a forward state metric in case an input i is 0 or in case the input i is 1 by using the calculated branch metric; d) calculating a log likelihood ratio by using the forward state metric and the reverse state metric; and e) storing the log likelihood ratio,

wherein the log likelihood ratio L_k is calculated by using an equation $\sum_{m=0}^{2^v-1} (A_k^{1,m} + B_k^{s(m)})$

$- \sum_{m=0}^{2^v-1} (A_k^{0,m} + B_k^m)$ wherein m is a state of a trellis diagram; $s(m)$ is a function provides a

number complemented a Most Significant Bit(MSB) of binary number of m ; $\sum_{j=0}^1$ is a

function defined as $\sum_{j=0}^1 A_k^j = A_k^0 + A_k^1 = \log_e(e^{A_k^0} + e^{A_k^1})$; j is a $(k-1)^{th}$ input for a reverse state

metric; k is a stage; $A_k^{1,m}$ is a k^{th} forward state metric with state m and input 1; $B_k^{s(m)}$ is a

k^{th} reverse state metric with state $s(m)$; $A_k^{0,m}$ is a k^{th} forward state metric with state m and

input 0 and B_k^m is a k^{th} reverse state metric with state m ."

Applicant's new claim 21 contains the limitations of "[a] computer-readable recording medium storing instructions for executing a calculation method implemented to a turbo decoder, comprising functions of: calculating a branch metric by receiving symbols; calculating a reverse state metric in case an input i is 0 by using the calculated branch metric and saving the calculated reverse state metric in a memory; calculating a forward state metric in case an input i is 0 or in case the input i is 1 by using the calculated branch metric; calculating a log likelihood ratio by using the forward state

metric and the reverse state metric; and storing the log likelihood ratio, wherein the log

likelihood ratio L_k is calculated by using an equation
$$A_{m=0}^{2^v-1} (A_k^{1,m} + B_k^{s(m)}) - A_{m=0}^{2^v-1}$$

$(A_k^{0,m} + B_k^m)$ wherein m is a state of a trellis diagram; k is a stage; j is a $(k-1)^{th}$ input for a

reverse state metric; $s(m)$ is a function provides binary number of m with a most

significant bit complemented; $A_{j=0}^1$ is a function defined as $E_{j=0}^1 A_k^j = A_k^0 E A_k^1 =$

$\log_e(e^{A_k^0} + e^{A_k^1})$; $A_k^{1,m}$ is a k^{th} forward state metric with state m and input 1; $B_k^{s(m)}$ is a k^{th}

reverse state metric with state $s(m)$; $A_k^{0,m}$ is a k^{th} forward state metric with state m and

input 0 and B_k^m is a k^{th} reverse state metric with state m ."

Lerzer discloses that the Branch Metric is used for the Likelihood Ratio Calculation (LRC). Lerzer clearly shows this in equations (4) and (4'') as illustrated in the following equations (see Lerzer, column 5, eq. (4), column 6, eq. 4'').

Equation (4) in column 5	Equation (4'') in column 6
$\Lambda_k = \frac{P(u_k = +1 y)}{P(u_k = -1 y)}$ $= \frac{\sum_{s_{k-1}, s_k, u_k = +1} P(s_{k-1}, s_k, y)}{\sum_{s_{k-1}, s_k, u_k = -1} P(s_{k-1}, s_k, y)}$ $= \frac{\sum_{s_{k-1}, s_k, u_k = +1} \alpha_{k-1}(s_{k-1}) \cdot \gamma_k(s_{k-1}, s_k) \cdot \beta_k(s_k)}{\sum_{s_{k-1}, s_k, u_k = -1} \alpha_{k-1}(s_{k-1}) \cdot \gamma_k(s_{k-1}, s_k) \cdot \beta_k(s_k)}$	$L_k = \text{Max}_{s_{k-1}, s_k, u_k = +1} (a_{k-1}(s_{k-1}) + c_k(s_{k-1}, s_k) + b_k(s_k)) -$ $\text{Max}_{s_{k-1}, s_k, u_k = -1} (a_{k-1}(s_{k-1}) + c_k(s_{k-1}, s_k) + b_k(s_k))$

In Applicant's claimed invention, however, the Branch Metric is not used for the LRC. Also, the equation used for the LRC is less complex than in Lerzer as Applicant's LRC is based on the simplification of the reverse state metric calculation. Applicant's claimed equations for the LRC are asserted in Applicant's specification in Equations 33 and 37 at pages 22 and 23, and contained in claims 13, 15 and 21 listed above as follows:

$$L_k = \sum_{m=0}^{2^v-1} (A_k^{1,m} + B_k^{s(m)}) - \sum_{m=0}^{2^v-1} (A_k^{0,m} + B_k^m) \quad \text{Eq. 33}$$

$$L_k = \sum_{m=0}^{2^v-1} (A_k^{1,m} + B_k^{s(m)}) - \sum_{m=0}^{2^v-1} (A_k^{0,m} + B_k^m) \quad \text{Eq. 37}$$

Accordingly, by using simplified equations for the LRC, Applicant's claimed invention provides a turbo decoder with less calculation steps and, therefore, reduced size. Thus, Applicant's claimed invention can be implemented as an application specific integrated circuit (ASIC) or a field programmable gate array (FPGA).

Lerzer does not teach, disclose or suggest all the limitations contained in Applicant's amended claims 13, 15 and 21, as listed above. Since Lerzer does not teach, disclose or suggest all the limitations of Applicant's amended claims 13, 15 and 21, there would not be any motivation to arrive at Applicant's claimed invention. Thus, Applicant's amended claims 13, 15 and 21 are not obvious over Lerzer in view of no other prior art since a *prima facie* case of obviousness has not been met under MPEP §2142. Additionally, the claims that directly or indirectly depend from amended claims 13 and 15, namely claims 14, and 16-20, respectively, would also not be obvious over Lerzer in view of no other prior art for the same reason.

Accordingly, withdrawal of the 35 U.S.C. § 103(a) rejections for Claims 1-5 and 7-10 are respectfully requested.

III. Claims 11-12 Not Rejected Over Prior Art

Applicant notes that claims 11-12 were canceled and replaced with new claims 22-23 to overcome the 35 U.S.C. § 112, first paragraph rejections and are not rejected over prior art. Applicant presumes the arguments and amendments presented in the response mailed October 1, 2004 overcame the prior art rejections as the Office Action made no specific mention.

Applicant respectfully asserts that claims 13-23, as it now stands, are allowable for the reasons given above.

CONCLUSION

In view of the foregoing, it is submitted that claims 13-23 patentably define the subject invention over the cited references of record, and are in condition for allowance and such action is earnestly solicited at the earliest possible date. If the Examiner believes a telephone conference would be useful in moving the case forward, he is encouraged to contact the undersigned at (310) 207-3800.

If necessary, the Commissioner is hereby authorized in this, concurrent and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§1.16 or 1.17, particularly, extension of time fees.

Respectfully submitted,

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Dated: March 1, 2005

By: _____

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail with sufficient postage in an envelope addressed to: Mail Stop AF, Commissioner for Patents, P. O. Box 1450, Alexandria, Virginia 22313-1450 on March 1, 2005.

Jean Svoboda